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ABSTRACT

Administrative and empirical factors affecting the relationship between changing workloads and concomitant budget adjustments are examined in this analysis of the funding structure by which state aid to each California community college is adjusted for increases or decreases in average daily attendance (ADA). The report first describes current state funding policies which call for the utilization of marginal, rather than average, cost adjustments in response to ADA changes. This is followed by an examination of nine administrative questions to be considered before any changes in current policy governing incremental costs can be considered. These questions address the appropriateness of the marginal cost rate applied in current policy, the fiscal distinctions between large and small college districts, and the effectiveness of using several workload measures, rather than only ADA, in identifying and predicting costs. The report then discusses the theories of marginal costs and economies of scale which underlie present state policy and summarizes the results of a linear regression analysis undertaken to determine the annual marginal rates over a six-year period for six cost categories and their representative workload indicators. Regression tables are appended. (JP)

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INCREMENTAL COST STUDY

CHANCELLOR'S OFFICE

CALIFORNIA COMMUNITY COLLEGES

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SACRAMENTO

JANUARY 1980

JC 800 352

INCREMENTAL COST STUDY

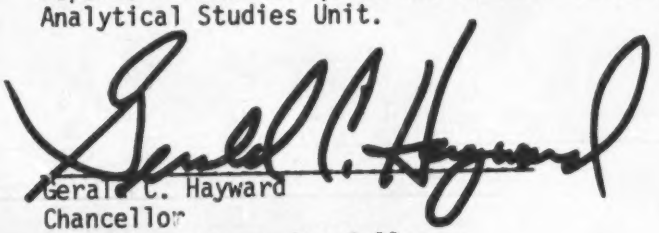
PREFACE

This report has been prepared in response to supplemental language in AB 8, the major funding measure for local agencies, including California Community Colleges during 1979-80 and 1980-81. This supplemental language requires the Chancellor to study the incremental cost rates used in AB 8 for funding community college workload changes, including the various cost factors that are part of the overall rate, and recommend changes in the rate, if appropriate.

After considerable staff study, we have concluded that any changes to present policy and, specifically, the existing incremental cost rates would be premature. With the several exceptions noted in this report, present policy accomplishes the intended objectives of (a) providing a more precise fit between the level of support and the cost of college programs, (b) recognizing the budget problems of colleges with declining enrollments, and (c) eliminating incentives for unwarranted growth in enrollment.

Before suggesting any changes to the present incremental cost policy, there needs to be some improvement in our fiscal data and additional empirical analysis. In any case, possible changes must be reconciled with provisions of Proposition 4 (the Gann Initiative), passed in November 1979. Work to analyze and reconcile differences among AB 8, the Gann Initiative, and policies proposed in the Board of Governors' Long-Term Finance Plan for community colleges is proceeding and will be complete early this spring.

This study of incremental costs was prepared by Leonard Shymoniak, Research Specialist, and Chuck McIntyre, Director of the Analytical Studies Unit in this office. Earlier draft versions of this report were reviewed by the Board of Governors' Finance Committee and several technical advisory committees. Work on certain of the issues concerning incremental costs and funding policies generally will continue and we would appreciate your comments and suggestions once you've had an opportunity to review this report. Technical questions on the analysis should be referred to the Analytical Studies Unit.



Gerald C. Hayward
Chancellor
California Community Colleges

January 4, 1980
Sacramento

BACKGROUND

The Legislature adopted a funding structure in AB 8 (1979) for community college districts which uses a base or prior year budget adjusted for:

(a) inflation,

(b) programmatic changes, and

(c) workload changes.

Workload changes are to be supported at their "incremental" costs. Lacking precise data, AB 8 defined incremental costs as two-thirds of the district or statewide average cost per unit of average daily attendance (ADA), depending on the district's size and whether its ADA is increasing or decreasing.

Use of incremental cost rates is intended to measure more precisely than did the traditional average cost mechanism, year-to-year fiscal changes faced by community college districts. This new measure should be effective both for increases as well as decreases in enrollment, specifically providing the fiscal cushion needed by those districts experiencing declining enrollments.

Incremental costs are less than average costs in the typical community college. Funding a decreasing-enrollment district at the average rate, therefore, is inappropriate since it reduces revenue more than the district can reduce expenditures. Funding a growing district at the average cost rate is likely to be excessive since the average cost exceeds the incremental cost for that growth.

Incremental, rather than average cost, support is also intended to eliminate incentives for unwarranted growth in enrollment, a problem perceived by the Legislature to be inherent in prior community college funding policies. However, the Legislature also opted for a more direct limit to community college growth in AB 8: a fixed total appropriation based upon expected growth in ADA (2 percent this year).

AB 8 also requires further study of the incremental cost concept:

84714. The chancellor shall conduct a study on the incremental cost rate used in Section 84702 of this article, including a study of the various cost factors that are part of this overall rate. Prior to January 5, 1980, the chancellor shall make recommendations to the Legislature on appropriate changes in this rate or its components.

The concerns spelled out in Section 84702 are addressed in this report: namely, analysis of the overall incremental cost rate and the various cost factors that are part of the overall rate. Recommendations on any appropriate changes to the overall rate and its components will occur after differences among AB 8, the Gann Initiative and policies within the Board-adopted Long-Term Finance Plan are discussed and reconciled. The necessary reconciliation will be completed early in 1980.

This report begins by discussing present policy on incremental costs, then explores several key policy questions concerning this funding technique. This is followed by discussion of the theory underlying incremental or marginal costs and a final section which presents results of empirical study on the relevant cost relationships.

PRESENT POLICY

Legislation

The following specific conditions and incremental cost rates are defined in AB 8:

District Size (ADA)	ADA Change	Incremental Cost Rate
Equal to or greater than 3,000	decrease	two-thirds of district revenue per ADA
Equal to or greater than 3,000	increase	two-thirds of statewide revenue per ADA
Less than 3,000	decrease	two-thirds of statewide revenue per ADA
Less than 3,000	increase	two-thirds of statewide revenue per ADA

Resulting incremental cost rates for several districts are estimated in Table 1. The treatment of districts enrolling less than 3,000 ADA recognizes the large differences between average and incremental costs in small districts. For West Hills, one of the highest-cost small districts, the incremental cost rate turns out to be just one-third, rather than the standard two-thirds, of the district's average cost rate.

A significant amount of equalization is incorporated in the incremental costs applied to large districts under present policy. All large districts face a similar proportionate (two-thirds) but quite different absolute loss of revenue per each unit loss in ADA. Also, the very high-spending district receives just over half of its average cost for each additional ADA, while the lowest-spending district receives more than four-fifths of its average cost for each additional ADA.

TABLE 1

INCREMENTAL COST ESTIMATES FOR 1979-80
SELECTED COMMUNITY COLLEGE DISTRICTS

	1978-79		Estimated Incremental Cost Rate per ADA for 1979-80 IF	
LARGE	ADA	Revenue Per ADA	Increasing	Decreasing
San Diego	30,260	$ 1,268	$ 1,139	$ 845
Glendale	5,310	1,573	1,139	1,049
Peralta	18,382	1,662	1,139	1,108
West Valley	10,442	1,725	1,139	1,150
Kern	9,966	1,936	1,139	1,291
Mira Costa	3,877	2,292	1,139	1,528
SMALL				
Imperial	2,714	1,885	1,139	1,139
Lassen	1,868	2,007	1,139	1,139
West Hills	1,164	3,743	1,139	1,139
STATEWIDE		1,708	1,139	1,139

Source: Chancellor's Office, California

NOTE: AB 8 also contains a provision for computing 1978-79 ADA for funding purposes. A district losing more than 7 percent of its 1977-78 ADA in 1978-79 is deemed to have lost just 7 percent for purposes of calculating the change in ADA between 1978-79 and 1979-80 and subsequent application of the incremental cost rates.

Board of Governors' Policies

Relevant Board of Governors' policy proposals, listed in its Long-Term Finance Plan are as follows:

- *Begin with each district's 1979-80 base budget, comprised of state and local tax revenues for instruction and community services.*

- *Adjust base budgets where necessary to insure equality of access to educational services. The finance plan must recognize and preserve or adjust legitimate and desirable differences among college districts, while at the same time work to eliminate, within a reasonable phase-in period, the equitable effects of district wealth and tax-rate and of former block grant funding techniques.*

- *Adjust base budgets to separate those tax revenues intended for capital outlay, as opposed to operating budget, purposes.*

- *Make annual changes to the base budget for*

  - o *inflation, using an index of costs such as that describing State and Local Government Purchases of Goods and Services;*

  - o *workload changes in instruction and other services, using marginal or incremental, rather than average or total, support rates; and*

  - o *program changes, the rationale for which would be included in the districts' plans and with extra funding, if necessary, sought from the Legislature.*

- *Use several measures and related support rates, rather than one, to recognize the differential costs of workload changes in instruction and other services.*

	(activity)	*(measure)*
(a)	*traditional classroom instruction (recognize and reflect extreme marginal cost differences in the delivery of classroom instruction)*	*student classroom contact hours*

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(b)	*individualized instruction*	*student credit hour or other appropriate measure(s)*
(c)	*support services (learning resources centers and student personnel services)*	*student headcount enrollment*
(d)	*administration*	*character and size of non-administrative staff*

- *Place minimum restrictions on use by districts of base budget funds consistent with appropriate accountability for state educational interests.*

- *Retain existing categorical aids for the educationally and economically disadvantaged. Pursue Board-established goals for these programs as a supplement to the base budget. Revise funding policies for handicapped programs and make the process more like that for Extended Opportunity Programs and Services (EOPS).*

The Board's Plan argues that funding for the long term should maintain present categorical aid programs in approximately their same relationship to general funds whose use is not specified. Funding should be workload-driven and provide adequately for year-to-year changes, note cost differentials, establish desired incentives, and be accompanied by an effective planning and budgeting process.

The Board's proposed funding technique for college operations provides a stable base budget to which adjustments are made annually. Adjusting at marginal (rather than average) rates eliminates unwarranted incentives for growth and should take the place of an aggregate state-imposed ceiling on funding which can be devisive and complicating. A simplified version of the proposed funding technique is illustrated in Appendix A.

Many essential features of the Board's proposal are incorporated in AB 8. Yet to be accomplished are (a) the development of several workload measures, (b) a better framework for defining funding equity among districts, and (c) a more precise structure of incremental cost rates. All of this, of course, must be reconciled with provisions of Proposition 4.

POLICY QUESTIONS

Review of existing statutes and the results of this study reveal a number of important questions that should be addressed before any changes to present policies are considered. These questions are:

1. Is the current incremental cost rate policy (two-thirds of average costs) appropriate?

2. Should incremental cost rates be unique for each district or based upon statewide relationships?

3. Is a distinction regarding incremental cost between large and small distircts justified?

4. Can a fast-growing, high-spending district sustain its programs and/or level of services if added enrollments are supported at two-thirds the rate for existing enrollments?

5. Can a high-cost (per ADA) district more easily accommodate decreases in ADA than a low-cost district?

6. In view of certain institutional policies, such as faculty tenure and layoffs, does the incremental cost concept work in the same way for decreased workload as it does for increased workload?

7. Will several measures or cost factors identify the cost of community college workload changes better than one measure?

8. Will use of several workload measures to generate district funds improve incentives for effective local planning and budgeting?

9. Does the use of incremental costs reduce incentives for districts to undertake new high-cost programs demanded by the community?

Definitive answers to all these questions are premature given the changes to AB 8 that may result from application of the Gann Initiative. However, some preliminary discussion of each question appears useful.

1. Is the current incremental cost rate policy (two-thirds of average costs) appropriate?

Analysis reveals that, during the 1970's, incremental costs were higher than the two-thirds policy, in some cases as high as 90 percent of average costs. This historic relationship seems due to funding policies that were largely unrelated to workload (SB 1641 tax-rate control) or based on average costs (SB 6 revenue control). The inability to isolate costs attributable to new college programs or improved levels of service also complicates the analysis.

While the incremental cost rates in AB 8 are admittedly arbitrary, further analysis of the precise relationship between community college costs and workload should be completed before changes to present rates are considered.

2. *Should incremental cost rates be unique to each district or based upon statewide relationships?*

Once the local circumstances of each community college district are identified and accurately measured, it can be argued that each district has its own unique cost/workload relationship and, therefore, should be funded by a unique incremental cost rate.

Analyses using historical data to determine these unique rates, however, suffer from (a) imprecise data and (b) an inability to accurately distinguish between "what has been" and "what ought to be." The latter concept relates to efforts at equalization of inappropriate differences in district expenditure levels. Using unique rates based upon historical spending patterns will tend to perpetuate inequities in levels of service among districts.

Short of further analysis, the present policy where "poor" districts receive relatively higher support for growth and lose absolutely less support for decline, than do "rich" districts, seems a reasonable first approximation.

Further analysis of this question will need to relate the unique rate problem closely to the problem of improving the technique of adjusting inflation rates to make the funding of districts more equitable.

3. *Is a distinction regarding incremental cost between large and small districts justified?*

Results of this study indicate that there needs to be a distinction in the incremental cost rate based upon district size. In general, there is a much greater difference between marginal costs and average costs in small districts than in large districts.

Present incremental cost policy incorporates a size distinction by treating districts of less than 3,000 ADA differently than other districts. In view of the previous "small district formula," use of this threshhold is appropriate until further study demonstrates the need for (1) a different cut-off, (2) less dichotomous and more continuous or gradual changes in relation to size, or, perhaps, (3) further distinction(s) at other, higher levels of ADA.

4. *Can a fast-growing, high-spending district sustain its programs and/or level of services if added enrollments are supported at two-thirds the rate for existing enrollment?*

This question will apply to a relatively small number of districts during the 1980's. The specific problem results from continuous and large enrollment gains. Districts experiencing a significant increase followed by stable or declining enrollment face a different set of problems.

There are few instances during the 1970's where districts' real funding, year after year, was not at close-to or above prior average levels. Consequently, there is little experience to review in answering this question. Incremental costs appear sound in both theory and practice for small changes in workload. Significant or massive changes in workload, such as a 20 percent increase in ADA or continuous 10 percent annual increases in ADA, however, may require different funding treatment.

The program change funding component of the proposed Board of Governors' finance policy is intended, in part, to provide for this kind of problem. Exploration of a formula-based solution to this problem also would be useful.

5. *Can a high-cost (per ADA) district more easily accommodate decreases in ADA than a low-cost district?*

This question encompasses two major problems, the solutions to which may be contradictory.

On the one hand, an overt policy of equalization would decrease the budget for a high-cost district at a higher rate than that for a low-cost district. This approach is embodied in AB 8, where Mira Costa, a high-cost district ($2,292 per ADA) , loses ADA at the rate of $1,528 while San Diego, a low-cost district ($1,268 per ADA), loses ADA at the rate of $845. These rates represent the same proportion (two-thirds) of average cost in each case. Equalization proponents might argue for even greater-than-proportional differentials.

On the other hand, one may argue that size differences and scale economies along with the cost character of programs demanded by the community are more important considerations. Consequently, Mira Costa, a relatively small district with (hypothetically) higher-than-average cost programs preferred by its community, should face a relatively smaller incremental cost rate and, therefore, a smaller rate of support loss per unit loss in ADA than does San Diego.

Present policy also observes this argument, even if indirectly, by reducing the dozen small districts at the statewide average incremental rate of $1,139, typically between one-third and one-half of the average cost of these normally higher-spending districts. Once again, the incremental cost and equity or equalization considerations become interrelated. Further analysis of the components of district budgets to identify relevant cost factors is necessary before changes to present policies can be considered.

6. *In view of certain policies, such as faculty tenure and layoff, does the incremental cost concept work in the same way for decreased workload as it does for increased workload.*

The incremental cost concept probably does not work quite as well for decreases in workload as it does for increases in workload. An increment of $1,000 each for a small additional group of students may be easily accommodated since, in many instances, these students are simply added to existing course sections and demands on other support services may increase only moderately. A loss of $1,000 each for a small decrease in students may be difficult to accommodate for the same reasons. Course sections, in many cases, become smaller, but can't be closed and, thus, faculty staffing (and the instructional budget) is unchanged. Support services may change only moderately. Incremental support rates, however, are a vast improvement over prior funding policies in which funds were reduced at a higher, average rate in the case of declining enrollments.

Major problems with declining enrollments concern budget timing and staff layoff policies. Community colleges are funded on a current basis and unanticipated losses in ADA result in revenue losses which were not anticipated at the time budgets were developed and approved. (It is of some help to districts that, under current policy, their prior year budget revenues plus an inflationary adjustment can be predicted early in the budget cycle.)

Under present law, full-time certificated staff must first be notified by March 15th with a final decision on May 15th if they are not to be rehired for the subsequent academic year. These faculty can only be dismissed if (a) the district has experienced an ADA loss from either of the two previous years or (b) a particular kind of service is to be reduced or discontinued the following fall. Regular employees can't be dismissed due to lack of funds.

It if virtually impossible for college budget planners to adequately predict enrollments, nearly a year in advance so that intelligent decisions may be made regarding faculty layoffs. One way of solving this timing problem and increasing budget flexibility has been to use part-time faculty, very few of whom have the same employment rights as full-time certificated faculty. At present, about 30 percent of community college instruction statewide is taught by part-time faculty. Even so, the timing of layoff decisions and budget development remains a problem, particularly for the district that is anticipating declining enrollments and has relatively few part-time faculty.

7. *Will several workload measures or cost factors identify the cost of community college workload better than one measure?*

In theory, several workload measures are preferable to one. Workload in traditional classroom instruction may be measured accurately by the classroom contact hour, as at present. This measure is not a valid proxy for all other college activities, however. Individualized instruction, for example, requires a different approach. Measures other than the contact hour are needed to recognize the more or less-than-traditional amount of direct student-faculty contact involved in television, audio-tutorials, independent study, self-paced mastery learning, and other modes of instruction that take place in other than the traditional lecture or laboratory setting.

Plant maintenance and operation costs are more a function of campus acreage and the size, character, and age of buildings than a function of student classroom contact hours. Likewise, student support services costs, such as those for counseling, would appear to relate better to a measure such as headcount enrollment than to classroom contact hours. In addition, costs for each of the different major college functions relate differently to changes in their respective workload measures. Therefore, the relationship between incremental and average costs for each measure would be different, rather than the same as assumed by the use of one measure.

Several measures or cost factors are analyzed in this study: instruction, student support services, plant maintenance and operation, administrative, and general institutional management. Using historical data, the predictive success of these measures is mixed and the incremental cost results, in some cases, are quite unexpected.

Before several measures are used to determine costs and support, there needs to be (1) improvement in the quality of the necessary fiscal and workload data, (2) a determination that historical relationships are, in some sense, appropriate, and (3) a conclusion that use of several measures will not impose undesirable incentives on district planning and budgeting. Data are being improved and the appropriateness of past funding is being examined. Incentives resulting from the use of several measures is the topic of the next question.

8. *Will the use of several workload measures to generate district funds improve incentives for effective local planning and budgeting?*

The Board of Governors' proposed use of several workload measures specifically notes that the use of these funds should not be categorically restricted. Even with this caveat, however, it is doubtful that incentives for effective local planning and budgeting would be improved.

On the one hand, explicit recognition of the various cost factors: their workload and related support within a district budget could lead to a more complete discussion of the district budget than occurred previously. The district also might beg a "break" in its total funding where one or more of several measures, say headcount enrollment, are increasing while contact hours are decreasing. Using several measures, this district would receive some increased funding. Using one measure, this district would face a decrease in funding.

On the other hand, use of the several workload measures could restrict the district from freely allocating its resources to certain effective uses. These uses, for example, may have been identified as meeting community educational needs, but are not consistent with or reflected in the measures contained in the standard funding formula for workload changes. This situation likely would not lead to an effective allocation of local resources.

9. *Does the use of incremental cost rates for workload changes reduce incentives for districts to undertake new, high-cost programs demanded by the community?*

The Board of Governors' proposal, incorporated in AB 8, uses a program change category to handle those new programs which cannot otherwise be supported by reallocating some portion of an existing district budget.

There is some greater state review and accountability possible under this proposal. However, districts are free, as they have always been, to undertake new programs from within existing resources. No prior community college funding policy contained explicit provision for the funding of new programs or program changes.

Under prior policies where growth was funded at an average rate which exceeded the actual incremental cost of that growth, districts did receive "extra" funds which were used, in many instances, to initiate new programs. However, the availability of such extra funds did not always coincide with the need for new programs. Besides being inappropriate, this technique won't operate in a situation where some, but not all, districts expect to grow during the next decade.

THEORY

The notion of incremental or marginal costs is based upon the way resources are used to produce goods and services. Any agency, public or private, incurs certain fixed costs, regardless of how many goods or services are produced; i.e., a community college has certain fixed costs, such as the President's salary, regardless of the college's enrollment. Total community college cost then is the sum of these fixed costs plus the variable costs, such as faculty salaries, associated with each student enrolled. Average cost is the total cost divided by the number of students. Since, by definition, it excludes the fixed cost component, the additional or incremental cost to educate each student of an additional group of students is likely to be less than the average cost for all students enrolled.

Incremental costs can be defined as the change in college expenditures per student or any other workload unit that occurs when adding or losing, respectively, a group of students. Marginal cost, by contrast, is defined as the change in college expenditures for a change in one student or one unit of workload.

A simple example illustrates the difference between the concepts of average and marginal or incremental cost. The initial equipment and other fixed costs for teaching drafting may be quite high, but the cost of adding one or several students to the program is nominal. This is because the added students merely fill existing course sections and few added demands are put on the library, counselors, and other college supporting services. The average cost per student is high (due to the high fixed costs and, therefore, high total cost) but the marginal or incremental cost to add a student or group of students is low.

As a community college grows, courses are established and filled until, at some point, they become too large for effective learning and are broken into two or more sections. Only after many courses are sectioned on a large campus does average class size tend to stabilize regardless of further enrollment growth. Likewise, spending for general administration, library, student services, and plant maintenance and operation does not increase proportionately with enrollment increases during the early growth of a college.

Thus, as a college grows in enrollment, the marginal costs of adding students are less than the average costs of those already enrolled. As average costs per student decline, "economies-of-scale" are exhibited. At some point, due to course sectioning and staff and equipment duplication, average costs per student stabilize; i.e., the marginal costs of adding students are about the same as the average costs of those already enrolled. Average costs may even increase at some point ("diseconomies-of-scale"), although study of data for California Community Colleges does not conclusively support this concept.

Many of the same factors influence college expenditures as a college declines in enrollments and fixed costs become a greater proportion of total costs. There are also some policy constraints, however, that are operative on the enrollment downswing but which are not factors in growth situations.

Economies of Scale

Most aspects of community college operations, including instruction and support activities such as college management, facility maintenance, and capital costs, appear subject to economies of scale; i.e., costs per student decreases (increase) as the number of students increases (decrease).

While both capital and operating costs are important, it should be noted that the former amounts to less than one-fifth the magnitude of the latter. Capital cost differences due to different-sized college operations are an obvious, but minor consideration. The best comparison for capital costs is between alternatives: one where all enrollment is housed in one large campus; the other where enrollment is housed in two or more smaller campuses.

The costs of masterplanning, land acquisition, site development, and basic utilities are added when a new campus is initiated. These outlays are unnecessary if an existing campus is expanded without need to acquire new land. These added expenditures may be significant.

There are, in addition, certain physical facilities which would serve for a single campus of, say, 10,000 students but which would need to be duplicated if the same group of students were split between two campuses. Such buildings as the gym, theatre and auditorium, student center, and corporation yard normally exist in some form regardless of campus enrollment. Library book collection facilities and faculty offices exhibit some of the same economies of scale as campuses become larger. The former is due to the need for a "core" collection regardless of enrollment. The latter is due, simply, to the larger student:faculty ratio on larger campuses.

Spending for the operating costs of general administration, library, student services, and plant maintenance and operation also exhibits scale economies. For example, a college normally employes only one president, one dean of students, etc., regardless of the size of student enrollment. Other staffing in these areas is related only partially to enrollment changes. Thus, costs in these areas do not increase in the same proportion as enrollment increases.

Instructional costs, the bulk of college budgets, also exhibit scale economies. Faculty salaries constitute the bulk of such costs. Therefore, the student-faculty ratio is quite important. The ratio itself is a function of the type and extent of course work undertaken by the student, average class size, and units of work expected of faculty. A large ratio results in low costs per

student while a small ratio results in high costs per student. The student: faculty ratio varies inversely with (1) the amount of course work taken by each student and varies directly with (2) faculty teaching load and (3) average class size.

The average number of course units taken per student is generally similar in all districts and unrelated to college size. Faculty teaching workload is a policy determination of the local governing board and does not appear related in size. By contrast, the third variable, average class size, is related primarily to size of enrollment, although course and sectioning policies, type and method of instruction, and, in some instances, the physical sizes of rooms also influence class size. It is impossible for the small college to conduct an adequate curriculum and, at the same time, have an appreciable number of large classes.

As the operation grows in enrollment, however, classes are increased or filled and average class size increases. Thus, it is expected that, other things being equal, total operating costs per student will decrease as size increases, though not necessarily without limit.

Estimates

The actual relationship of average cost and size is shown graphically in Appendix B where unit cost is a negative function of college size, in terms of ADA. Large districts with total ADA counts ranging from 20,000 to 30,000 operated in Fiscal Year 1978-79, on a unit cost between about $1,500 and $1,700 per ADA. Small districts with fewer than 3,000 ADA operated on a unit cost ranging from about $1,800 to $5,000 per ADA.

Previous analyses for a number of years indicated that the relationship of average cost and district size was curvilinear, dropping dramatically until about 3,000 ADA and appeared to be unrelated beyond this point. This work led to the small district funding formula.

Chancellor's Office analysis also indicates that the assignable square feet of building space per student was less in larger colleges during Fall 1975 than in smaller colleges. The relationship of space to students declines from zero to 6,000 day-graded college enrollment. Beyond this size there appears to be little or no relationship between space per student and the number of students.

Most experts assume that the relationship between costs and workload exhibit the properties shown in Figure 1. Here, total cost is a nonlinear function of workload. This is consistent with the above discussion of scale economies. Costs increase, but at a decreasing rate, until X_1 is reached. After this workload point costs continue to increase, but now at an increasing rate. The linear function shown in Fugure 2 may also be assumed to depict the relationship between cost and workload.

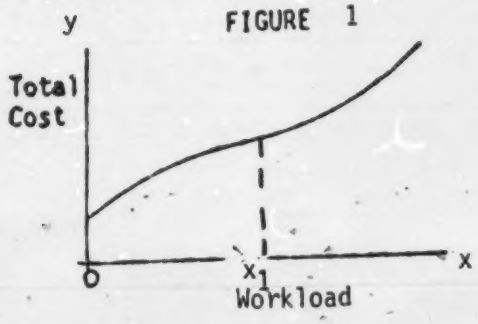

FIGURE 1

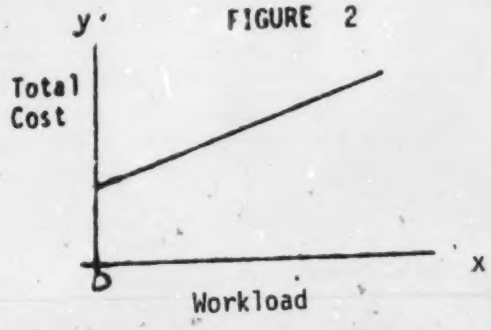

FIGURE 2

Empirical proof of these propositions is difficult for at least three reasons:

(a) arbitrary assumptions are necessary about uniformity of instructional quality; i.e., services to all students ~~are~~ are similar quality;

(b) data are incomplete, inaccurate, or both;

(c) historical data measure "what has been," rather than "what ought to be;" and

(d) the influence of factors such as fiscal policies and local budgetmaking preferences can seldom be accurately identified in this kind of statistical analysis.

To talk of decreasing unit costs, one must assume the quality and diversity of student units are equivalent, regardless of college size. If some colleges operate economically only by restricting programs to less than that offered by larger colleges, then scale economies do exist. However, if this is the practice, empirical examination will be conclusive only if the many interrelated variables are examined simultaneously (in what is known as a multivariable analysis). The same is true in the case of very large colleges where possible diseconomies of scale would make it difficult for the institution to grow without being subject to increasing unit costs per student.

It is not possible to isolate and assess all the changes in programs and levels of service that are incorporated in the cost data. These changes need to be separated from workload changes in order to complete an accurate analysis.

Accuracy of data is not a serious limitation for the analysis of the overall marginal rate but is pertinent in determining the various cost factors. Prerequisite to the analysis of cost factors is an accurate allocation of district expenditures to "cost centers." In 1978-79, four of the 70 districts did not report such data (i.e., Cabrillo, Chaffey, Hartnell, Yosemite). Moreover, it is believed there are some inconsistencies among districts in the manner of prorating costs among the various cost centers. One reason for this is that these data are not being used for funding and therefore are not subject to rigorous auditing and editing procedures. Limited use of the data does not demand strict district adherance to uniform cost allocation procedures. Consequently, districts vary in the application of procedures depending on locally-established accounting procedures.

A second data limitation in this analysis results from the use of historic community college cost data. Prior to the passage of Proposition 13, community college apportionments were driven by average unit costs. Undoubtedly, the formula for district receipt of funds influenced to some degree the manner in which expenditures were incurred. If this is the case, any marginal cost analysis based on historic data tends to reflect the influences of average cost funding. The lack of a substantial difference between marginal and average cost, therefore, may in part be attributable to past policy. It is expected that this problem will be resolved if the marginal cost funding introduced by AB 8 is continued in the future.

Isolation of factors such as wealth, tax effort, and, to some extent, programmatic differences and identification of their separate influence on costs is possible. More difficult, if not impossible in most cases, is the identification of conservative or liberal approaches toward the utilization of district resources and differences in budgetmaking among district administrators and trustees.

Cost data may be analyzed in basically one of two ways: (a) on a cross-section basis for all districts at a given point in time or (b) on a longitudinal or several year, time-series basis, for a given district or set of districts. Each technique has its advantages and disadvantages. The cross-section analysis ignores the dynamics of actual year-to-year changes in a district, but ignores significant state and local fiscal policy changes unless these can be specified. Both kinds of analysis are used in this report.

For policy purposes, it may be assumed that the linear relationship between costs and workload depicted in Figure 2 is appropriate. Both curvilinear and linear relationships were tested, and it was found that for all except the very large and very small districts the linear relationship adequately represents the community college district costs and workload.

To test the linear relationship and derive values for actual use, the following regression equation was fitted statistically to 1978-79 data for 70 community college districts:

$$Y = A + Bx + E$$

where

- Y = total operating costs per college
- x = total units of workload per college (measured in ADA)
- A = a constant: the intercept of the regression line on the vertical axis in Figure 2
- B = a constant representing the marginal cost per unit of workload: the slope of the regression line depicted in Figure 2
- E = the residual or error in prediction: the difference between the actual value of costs (y) and the predicted value for costs (Y).

The purpose of the analysis is to assess the linear form as a predictor of costs and determine values for B, the marginal cost, for policy use. By definition, the average cost:

$$\frac{A + Bx}{x} \quad \text{or} \quad \frac{A}{x} + B$$

is greater than the marginal cost, B, as long as A is greater than zero.

Regressions were run for the overall incremental or marginal rates during each year of the six-year period ending 1978-79. Regressions also were run for six separate cost categories and their representative workload indicators. This was done in order to address the legislative request for a study of "various cost factors" and also to address the Board of Governors' policy on use of multiple workload indicators.

FINDINGS

Overall Incremental Rate

To assess the changes in overall incremental or marginal rates during the past half decade, a linear regression model was applied to cost data for each fiscal year beginning 1973-74. No attempt was made to determine the cost factors of the overall rate for these periods. Two types of analysis were conducted, one using actual dollars and the other constant (1978-79) dollars.

Appendix C (Table 2 and Figure 1 through 6) provides results of the analysis of total cost (current expense of education) and workload (ADA) from 1973-74 through 1978-79 for 69 of the 70 districts. (Because of its extreme size, Los Angeles was excluded from the analysis.) The regression equation was statistically significant beyond the 99 percent level of confidence for each fiscal year. The total variation of cost explained by the regression equation (coefficient of determination) ranged from 97 percent in 1973-74 to 99 percent in 1977-78. That is, virtually all of the variation in total cost between districts, each year, was "explained" by the variations in ADA between districts.

Findings indicate the following differences between the average and the marginal cost rates:

YEAR	OVERALL COST PER ADA (Current Dollars) Average	Marginal	DIFFERENCE $	%
1973-74	$ 1088	$ 991	97	8.9
1974-75	1119	1036	83	7.4
1975-67	1198	1108	90	7.5
1976-77	1384	1251	133	9.6
1977-78	1558	1377	181	11.6
1978-79	1741	1505	236	13.6

For all fiscal years, the marginal cost rate was less than the average cost rate. The difference between the overall average and marginal cost rates ranged from $83 (7.4 percent) in 1974-75 to $236 (13.6 percent) in 1978-79. The constant or intercept factor was positive for all years and increased steadily (except for 1975-76 which was the year of legislatively-capped expenditures) from $238,900 in 1973-74 to $980,200 in 1978-79.

In order to hold constant the effects of inflation on marginal and average costs, cost data for the 69 community college districts were converted to constant 1978-79 dollars using the Consumer Price Index as a deflator. The linear regression analysis model was then applied to these data for the fiscal years 1973-74 through 1978-79. As before, ADA was used as the workload measure and Los Angeles District was excluded because of excessive size variance. Compared to the analysis using actual dollars, as expected, the level of

significance and the coefficient of determination remained unchanged for constant dollars. That is, the level of significance continued to exceed 99 percent and the regression equations accounted for 96.9 percent of 97.6 percent of the total variance between constant dollar current education expense and ADA workload. Again the intercept increased steadily every year except for 1975-76.

The average and marginal overall cost rates for the analysis of linear regression of the current education expenses in constant dollars is as follows:

	OVERALL COST PER ADA (Constant 1978-79 Dollars)		DIFFERENCE	
YEAR	Average	Marginal	$	%
1973-74	$ 1529	$ 1483	46	3.0
1974-75	1502	1391	111	7.4
1975-76	1492	1380	112	7.5
1976-77	1618	1464	154	9.5
1977-78	1701	1504	197	11.6
1978-79	1741	1501	236	13.6

Even though converting cost to constant dollars reduced somewhat the increase in unit cost over the six fiscal years, it did not narrow the difference between the average and marginal rates. Cost-of-living changes account for only a part of the changes in the marginal and average cost rates. It can be speculated that other factors, such as abnormal workload changes, statutory provisions which constrain the ability of districts to adjust to these workload changes, and frequent changes in overall funding policies are the major determinants of changes to average and marginal cost rates.

Another significant finding from these data is the relatively small difference, in most cases, between average and marginal costs over the period examined. Policies effectively provided average, rather than marginal funding during the years of greatest growth, 1973 through 1975. Following this, during two years of generally decreasing workload about half of college funding (local property tax revenues) was unrelated to workload changes.

Another, perhaps more important, factor causing marginal and average costs to be closely aligned is the impact of district decisions to fund programs or increased levels of service. A district experiencing growth in ADA and funding, as most did during the 1970's, could have allocated the added funds toward new programs and/or increased levels of service rather than operating at the same level of service, but theoretically lower real (price-adjusted) cost per student as suggested by the discussion of scale-economies.

In view of these factors, it is doubtful that the results portray cost/workload relationships based upon just the workload portion of a district's budget consideration. Consequently, the relatively small current difference (14 percent) between marginal and average costs found in this analysis does not necessarily justify a change in present policies that incorporate a one-third and, for some districts, up to one-half difference between the two measures.

Also mitigating against any change in current policy is the use of a linear, rather than curvilinear, model. It was noted earlier that the cost/workload relationship for community colleges may be curvilinear or even discontinuous (that is, changing radically at key enrollment levels). Further analysis is necessary to establish the possibility that alternative statistical forms would provide a more precise analysis for all districts, whether large or small.

Cost Factors

The cost categories analyzed are: instruction, student support services, plant operation and maintenance, administration, and general institutional support.

Appendix D, Chart 1, lists the budget codes and describes the activities included within each category of expenditure. Useable data for the different expenditure categories were available for 66 of the 70 districts for 1978-79. These data are voluntarily reported by districts and to date have not been extensively edited by the Chancellor's Office for appropriate categorization. As noted, it is likely that considerable variation exists among the 70 districts regarding the categorization of certain expenditures indicating some need to exercise caution in the interpretation of these results.

Results of the regression analysis for each of the various cost categories and their appropriate workload measures are shown also in Appendix D. These analyses are based on fiscal year 1978-79 data for 65 of the 70 districts. Four of the excluded districts (Cabrillo, Mendocino, Palomar, and Yosemite) did not report complete cost or workload data for this fiscal year and, therefore, were excluded from the analysis. Data for the Los Angeles Community College District was excluded from the analysis because of excessive size. Inclusion of Los Angeles in the analysis would have made the application of the linear regression model inappropriate because of excess size variance.

All linear regression equations in Appendix D, Table 1, describing the relationship between costs and workload, are statistically significant at a level of confidence exceeding 99 percent. The coefficient of determination, a statistic indicating the amount of total cost variation explained by the regression equation ranges from 98 percent for the category of "Total Expenditure" to 49 percent for "Planning." Findings indicate the following relationships between average and marginal costs for each factor:

Cost Category	Workload Unit	COST PER UNIT		DIFFERENCE	
		Average	Marginal	$	%
Instruction	ADA	$1158	$1038	120	10
Student Support	Student Hd.Ct.	102	66	36	65
Plant Operation & Maintenance	Gross Sq. Ft. (100s)	3773	3261	512	14
Planning	Faculty Hd.Ct.	1060	938	122	12
General Inst. Support	Student Hd.Ct.	104	75	29	28
Total Expenditures	ADA	1793	1532	261	17

The average rate is less than the marginal rate for all of the cost categories. The marginal cost rate for Total Expenditures is $261 or 17 percent less than the average cost factor. The difference between the average and marginal rates ranges from 10 percent for the category Instruction to 36 percent for Student Support.

The constant term A is positive for all cost categories. This constant amount, theoretically, represents a level of fixed expenditures incurred before any adjustments for workload changes are made. This constant term is $953,000 for Total Expenditures. (Figure 1 through 6 in Appendix D graphically illustrate the relationships of each of the cost categories and their respective workload measures.)

These findings are highly statistically significant and consistent with the theory described above. However, results for each of the factors appear counter-intuitive. One might expect the least difference between average and marginal cost to exist in the area of student support, general institutional support, and plant operation and maintenance. This would be due to the need for a complete or nearly complete complement of services for each added unit of workload, particularly in the student services area. For opposite reasons, one might expect the difference between average and marginal costs to be greatest for the area of college "planning (and management)," because its cost is not closely related to workload changes. Statistical results in each case show just the opposite of that expected. The greatest difference between marginal and average cost was found in those areas for which the least difference between marginal and average cost was expected. Further work using more precise data and alternative workload measures is necessary. In addition, case-by-case examination of district budgeting practices for each of these areas would be useful.

Longitudinal Analysis

Another approach to analyzing incremental costs is to compare year-to-year changes in total expenditures to corresponding year-to-year changes in workload at the statewide or district level. In many ways, this technique is less refined and, therefore, subject to greater limitations than the linear regression. Longitudinal analyses do not control for effects such as changes in state methods for apportioning funds, district board policy and special local circumstances. Some of these influences vary substantially in their effect on expenditure levels for different districts and fiscal year periods.

Changes in the method of apportioning state funds to community colleges undoubtedly impacted district expenditures. Subsequent to 1972, community colleges have experienced four major changes in the apportionment mechanism, each providing different incentives or restrictions for growth and different levels of district revenues for program maintenance and improvement. Before 1973-74, district revenues were largely dependent on statutorily-controlled property tax rates. The extent to which districts were able to accommodate rapid enrollment growth during this period depended heavily on growth in assessed valuation. Increases in assessed valuation proved to be inadequate to meet the enrollment growth needs of community colleges. This problem and a desire to reduce property taxes, led to SB 6 in 1973-74 which more equitably compensated district growth by funding colleges totally on the basis of average cost rates applied to ADA. In 1975-76, enrollment funding was capped at the 5 percent level. That is, the state funded ADA growth only up to 5 percent over the prior year. Increases beyond the 5 percent level were funded from local sources. Some districts eliminated programs to restrict growth within the 5 percent limit. Other districts absorbed the added cost at the expense of program quality, through increased class size or reduced support services. SB 1641 took effect in 1976-77 and provided state funds based on average costs and a local share determined by a fixed tax rate applied against the district assessed valuation. This was a period of rapid increase in assessed valuation, and local revenue generated by the fixed tax rates in SB 1641 was sufficient to meet the fiscal needs of districts that experienced a 4 percent statewide decline in ADA in 1976-77. Finally, in response to Proposition 13, SB 154 (1978) allocated state bail-out funds in the form of block grants based on funding at about 93 percent of the prior year's budgets. This forced districts to make an overall expenditure cutback of about $90 million in 1978-79 as compared to the prior year.

It is evident that these different funding approaches affected district policies on program changes, improvements and on meeting enrollment needs. Added to this problem is the fact that enrollment changes could not be predicted with any degree of certainty until after the fact, at the time when staffing and major expenditure commitments already were made. Consequently, longitudinal analysis of district costs indicates extreme variation and fluctuation. In many cases, little can be generalized from these changes other than the unique circumstances surrounding the particular district and the ability of that district to adjust expenditures commensurate with expected workload.

Examination of actual statewide data indicates extreme changes from year-to-year and some lag in the ability of districts to adjust expenditures to workload changes. Statewide, expenditures increased an average of 15 percent per year between 1973-74 and 1977-78 (see Appendix E, Table 1). Passage of Proposition 13 resulted in the first major decrease in total expenditure, by 1.4 percent in 1978-79. At the same time, workload increased through 1975-76, then decreased in 1976-77 and subsequent years. Holding inflation constant reduces the magnitude of the difference (see Appendix E, Table 2).

During periods of enrollment growth in 1973-74 through 1975-76, the incremental cost (in constant dollars) was less than the average cost; i.e., about 50 percent of average cost in 1974-75 and 93 percent of average cost in 1975-76. The following year, statewide expenditures increased by 6.2 percent while ADA declined by 4.2 percent. It appears that the enrollment decline was unexpected and districts were unable to adjust, resulting in a negative incremental cost statewide. In the following year, ADA leveled off (a 0.2 percent decline) while expenditures (in constant dollars) increased by 2.7 percent resulting, again, in a negative incremental cost. It is possible that uncertainty regarding future enrollment trends, led districts not to make program cutbacks in line with enrollment declines. In 1978-79, after Proposition 13, both workload and expenditures declined about 10 percent. Statewide, districts reduced expenditures by $1,519 for each unit of ADA lost. This was $110 or 7 percent below the average cost per ADA of $1,629 the prior year.

Analysis of actual fiscal data indicates that during 1973-74 through 1978-79 individual district incremental cost rates generally were greater than average cost rates. During the first two years of this period, characterized by enrollment growth, more than two-thirds of the districts experienced incremental costs that were higher than average costs. In periods of ADA decline, nearly all districts reported incremental costs that exceeded average costs.

District by district comparisons of incremental to average costs are not conclusive. The influence of state funding mechanisms, individual district board policies, and special local circumstances seem to predominate expenditure changes. District workload measured entirely in terms of ADA does not reflect program quality, improved services, or other considerations. The fact that districts report higher incremental costs during periods of ADA decline suggests they either could not or, more likely, did not need to reduce expenditures in proportion to workload changes. Use of an incremental, rather than average cost, concept softens the impact of this problem.

APPENDIX A

ILLUSTRATION OF
PROPOSED SUPPORT TECHNIQUE
BOARD OF GOVERNORS
LONG-TERM FINANCE PLAN
CALIFORNIA COMMUNITY COLLEGES

This simplified illustration begins with two districts (A and B) in similar circumstances during the base Year 1. Following Year 1, District A grows at a rate of 5 percent each year while District B declines at a rate of 5 percent. Other assumptions for both districts include:

YEAR 1

Enrollment	15,000
ADA	10,000
Base Budget	$15,000,000
State share (70%)	10,500,000
Local share (30%)	4,500,000
Average Revenue	1,500/ADA
Marginal Revenue	1,000/ADA
Annual increase in assessed value	10%
Annual inflation in costs	7%

YEAR 2

District A		District B	
(1) base + inflation: $15,000,000 x (1.07) =	$16,050,000	(1) base + inflation: $15,000,000 x (1.07) =	$16,050,000
(2) increment: + 500 ADA x ($1,070)* =	+535,000	(2) increment: -500 ADA x ($1,070)* =	-535,000
(3) add, result:	$16,585,000 (up 10.6%)	(3) deduct, result:	$15,515,000 (up 3.4%)
local share:	$ 4,950,000 (29.8%)	local share:	$ 4,950,000 (31.9%)
state share:	$11,635,000 (70.2%)	state share:	$10,565,000 (68.1%)
ADA	10,500 (up 5%)	ADA	9,500 (down 5%)
average revenue:	$ 1,579/ADA (up 5.8%)	average revenue:	$ 1,633/ADA (up 8.9%)

* Year 2 marginal revenue (assumes one support rate rather than several).

Year 3

	District A		District B	
(1)	base + inflation $16,585,000 x (1.07) =	$17,745,950	(1) base + inflation: $15,515,000 x (1.07) =	$16,601,050
(2)	increment: +525 ADA x ($1,145) =	+601,125	(2) increment: -475 ADA x ($1,145) =	-543,875
(3)	add, result:	$18,347,075 (up 10.6%)	(3) deduct, result:	$16,057,175 (up 3.5%)
	local share:	$ 5,445,000 (29.7%)	local share:	$ 5,445,000 (33.9%)
	state share:	$12,902,075 (71.3%)	state share:	$10,612,175 (66.1%)
	ADA	11,025	ADA	9,025
	average revenue:	$ 1,664/ADA (up 5.4%)	average revenue:	$ 1,779/ADA (up 8.9%)

The growing district, A, receives budget increases over 10 percent each year while B grows at just over 3 percent even though its enrollment is declining. This is due to inflation and the use of marginal support rates. If District B had lost revenue at the average rate, it would have experienced, in Year 3, a budget of $15,495,925, nearly $600,000 less than under the marginal support rate.

The average revenue for District A increases at between 5 and 6 percent yearly, reflecting economies-of-scale in the face of inflation: a lower rate than would have occurred under average funding.

The state share of support is increasing in District A, decreasing in District B. This is due to the assumed high growth rate in assessed value in relation to other growth rates.

Appendix B, page 26, was deleted due to irreproducibility.

It contained a graph illustrating Expenditure Per ADA and ADA for the California Community Colleges 1978-79

APPENDIX C
Chart 1

COST FACTORS

Dependent Variable	Expenditure Category	CID Codes	Workload Unit	Description
Y_1	Instruction	0100-6100	Weekly Student Contact Hours (ADA as proxy)	Instructional activities in Agriculture thru Apprenticeship, Academic Administration, and Course and Curriculum Development, Library, Media, Museums and Gallaries, Tutoring, and Direct Clerical Support.
Y_2	Support Services	6200-6400	Headcount Enrollment	Admissions and Records, Counseling and Guidance, Student Personnel Administration, Financial Aid Administration, Health Services and Student Transportation.
Y_3	Plant Operation and Maintenance	6500	Gross Square Feet of Facilities	Utilities, Building Maintenance, Grounds Maintenance and Related Custodial Services
Y_4	Administration	6600	Total Faculty	Planning and Policymaking (activities of central executive board related to entire district.)
Y_5	General Institutional Support	6700	Headcount Enrollment	Fiscal Operations, General Administration, Logistics, Staff Services, Community Relations
Y	TOTAL EXPENDITURES	0100-6700	Average Daily Attendance	SUM OF ABOVE

APPENDIX C

Table 1

Analysis of Total Current Education Expense (CEE) and Unit of Average Daily Attendance (ADA) 1/

California Community Colleges

	Fiscal Year Period					
	1973-74	1974-75	1975-76	1976-77	1977-78	1978-79
No. of Districts 2/	68	68	69	69	69	69
Average Cost per ADA in $	1088	1119	1198	1384	1558	1741
Marginal cost per ADA in $(B)	991	1036	1108	1251	1378	1505
Intercept in $1,000's (A)	239	331	303	557	782	980
Stand. error of marginalin $	22	23	23	24	27	32
Simple R (also BETA)	0.984	0.985	0.985	0.987	0.988	0.985
Coefficient of Deter. as %	96.9	97.0	97.0	97.5	97.6	97.1
Standard error in $1000's	1143	1326	1501	1575	1715	1873
District ADA						
Mean	7878	8959	9781	9514	9564	8588
Stand. deviation	6403	7161	7774	7814	7832	7124
District CEE in $1000's						
Mean	8043.5	9597.1	11143.3	12536.6	13957.4	13908.9
Stand. deviation	6444.0	7537.8	8743.9	9902.2	10922.6	10883.7
F-ratio	2065	2099	2240	2621	2692	2230
Significance Level						
Exceeds F=7 for 99%	yes	yes	yes	yes	yes	yes

1/ Based on the linear regression model Y=A+Bx+E where Y is the dependent variable, A is the constant term, B is the marginal, x is the independent variable measuring ADA workload and E is the error term.

2/ The Los Angeles CCD is excluded from the analysis because of excessive size variance.

APPENDIX C

Table 2

Analysis of Total Current Education Expense (CEE) and Unit of Average Daily Attendance (ADA) 1/
(In Constant 1978-79 Dollars)

California Community Colleges

	Fiscal Year Period					
	1973-74	1974-75	1975-76	1976-77	1977-78	1978-79
No. of Districts 2/	69	69	69	69	69	69
Average Cost per ADA in $	1529	1502	1492	1618	1701	1741
Marginal Cost per ADA in $(B)	1483	1391	1380	1464	1505	1505
Intercept in $1000's (A)	358	417	378	652	854	980
Stand. error of marginal in $	33	30	29	29	29	32
Simple R (also BETA)	0.984	0.985	0.985	0.987	0.988	0.985
Coefficient of Deter. as %	96.9	97.0	97.1	97.5	97.6	97.1
Standard error in $1000's	1711	1780	1869	1842	1871	1773
District ADA						
Mean	7878	8959	9780	9573	9560	8249
Stand. Deviation	6403	7161	7774	7814	7834	6847
District CEE in $1000's						
Mean	12041	12882	13625	14662	15237	14008
Stand. Deviation	9647	10118	10714	11582	11924	10933
F-Ratio	2065	2099	2240	2621	2692	2230
Significance Level						
Exceeds F=7 for 99%	yes	yes	yes	yes	yes	yes

1/ Based on the linear regression model Y=A+Bx+E where Y is the dependent variable, A is the constant term, B is the marginal, x is the independent variable measuring ADA workload and E is the error term.

2/ The Los Angeles CCD is excluded from the analysis because of excessive size variance.

FIGURES 1 - 6 OF APPENDIX C WERE DELETED DUE TO IRREPRODUCIBILITY.

These figures contained graphs illustrating District Total Current Education Expenditures and ADA for the California Community Colleges, 1973-74 through 1978-79.

APPENDIX D
Table 1

Linear Regression Analysis of Current Operating Expenditures and Workload Measures 1/

California Community Colleges
1978-79

Cost Category (Y)	Inst.	Stud. Sup.	Plant. Oper. & Main.	Planning	Gen. Sup.	Total Expend.
Workld. Measure (X)	ADA	Stud. Headct.	Gross Sq. ft.(1000s)	Fac. Headct.	Stud. Headct.	ADA
No. of districts 2/	66	66	65	60	66	66
Average cost (4)	1158	102	3773	1060	104	1793
Marginal cost ($)(B)	1038	66	3261	938	75	1532
Intercept in $1000's(A)	526	285	172	19	139	953
Stand. Error of Marg. ($)	23	4	323	125	5	32
Simple R (also BETA)	.985	.899	.789	.702	.877	.986
Coeff. of Deter %	97.1	80.9	62.3	49.3	77.0	97.3
Stand. error in $1000's	1300	437	757	391	558	1838
Workload measures						
Mean	8579	15030	444	504	15030	8579
Stand. deviation	7133	13402	296	407	13402	7133
Cost category in $1000's						
Mean	9427	1284	1620	492	1274	14097
Stand. deviation	7512	991	1222	544	1153	11079
F-ratio	2073	266	102	56	211	2264
Degrees of freedom	1,63	1,63	1,62	1,58	1,63	1,63
Sign. level						
Ex. F=7 for 99%	yes	yes	yes	yes	yes	yes

1/ Based on the linear regression model Y=A+Bx+E where Y is the dependent variable, the A is the constant term, B is the marginal factors, x is the independent variable measuring workload and E is the error term.

2/ Districts excluded because of unuseable cost and/or workload data were Cabrillo, Mendocino, Palomar and Yosemite. Los Angeles was excluded because of excessive size variance, which contradicts the theoretical construction for regression analysis.

Appendix D, Figure 1 - 6, were deleted due to irreproducibility. These figures contained graphs illustrating Total Expenditures and ADA for the California Community Colleges

APPENDIX E
Table 1

Changes in Statewide Current Education Expenditures, Workload in ADA and Cost Factors

California Community Colleges

	Average Daily Attendance			Current Education Expense ($1000's)			Costs			
		Change			Change			Change		
Year	ADA	No.	%	Total	$	%	Average	$	%	Incremental
1973-74	609,432	-	-	$625,407	-	-	$1,026	-	-	-
1974-75	694,096	84,664	13.9	743,472	118,065	18.9	1,071	45	4.4	$1,395
1975-76	768,902	74,806	10.8	881,509	138,037	18.6	1,146	75	7.0	1,845
1976-77	736,702	-32,200	- 4.2	996,295	114,786	13.0	1,352	206	18.0	-3,565
1977-78	734,915	- 1,787	- 0.2	1,096,799	100,502	10.1	1,492	140	10.4	-56,240
1978-79	658,716	-76,199	-10.4	1,081,614	-15,183	-1.4	1,642	150	10.1	199

APPENDIX E
Table 2

Changes in Statewide Current Education Expenditures, Workload in ADA and Cost Factors

California Community Colleges
(Constant 1977-78 Dollars)

	Average Daily Attendance			Current Education Expenditures (CEE)			Costs			
		Change			Change			Change		
Year	ADA	No.	%	Total	$	%	Average	$	%	Incremental
1973-74	609,432	-	-	$936,234	-	-	$1,536	-	-	-
1974-75	694,096	84,668	13.9	997,962	$61,728	6.6	1,438	$-98	-6.4	$ 729
1975-76	768,902	74,806	10.8	1,097,743	99,781	10.0	1,428	-10	-0.7	1,334
1976-77	736,702	-32,200	-4.2	1,165,267	67,524	6.2	1,582	154	10.8	-2,097
1977-78	734,915	- 1,787	-0.2	1,197,373	32,106	2.7	1,629	47	3.0	-17,966
1978-79	658,716	-76,199	-10.4	1,081,614	-115,759	-9.6	1,642	13	0.8	1,519

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